

Current situation of Chinese forestry tactics and strategy of sustainable development

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Abstract: Based on the analysis of the current situation of Chinese forestry and a series of ecological, environmental, economic, and social problems, this paper emphasized on the importance of forests in social and economic development in China. The author pointed out that sustainable development, particularly the sustainable development of forestry, is the inevitable choice to solve the problems of ecological environment and social economics. The objectives, criteria, and strategies of sustaining forestry were also demonstrated and expounded, from the viewpoints of ecology, economics, and sociology.

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Introduction

Forest is the source of material on which human live, and it is an important indivisible part of the social, economic sustainable development (Costanza *et al.* 1997). Forestry, which is the most powerful system of biological function on land, has an absolutely necessary status and effect in the aspects of regulating the earth environment (Lemly 1997). The sustainable development of forest ecosystem guarantees the sustainable development of agriculture ecosystem, grassland ecosystem, water ecosystem and urban ecosystem (Desai 1992; Keoleian *et al.* 1994; Costanza *et al.* 1995, 1997; Jamieson 1998). At present, a series of global ecological and environmental problems such as sharp decrease in forest resource and species, extinction of some species, land desertification, the shortage of freshwater resource (Penmngs 1996; Rosen 1997), and global climate warming were concerned in the sharp decrease and degeneration of forest vegetation (Peter 1991).

Present condition and the existing questions of Chinese forestry

China is a developing country with large population. Its economy is fleetly developing and industrialization is enlarging, which lead to increasing demand of timber and foodstuff. At the same time, the continuous development, exploitation, disturbance, and destroy of forest resources

make forest lessen year by year. Much forestland has been used as agricultural land or city. All the actions of short-term economic interest in price of ecology and environment lead to a unceasing decrease in primeval forest resources, a decline of productivity of natural secondary forest and artificial forest as well as forest function, a sharp decrease in species number, shortage of water resource, and increasing in land desertification, soil erosion and the mud-rock flow. As a result, all kinds of disasters frequently occur and the human living environment is deteriorating. The ecologists, environmentalists, and forest scientists are studying and solving these forestry problems in China so as to realize the sustainable development of society, economics, resource, and environment.

Northeast forest region

The northeast forest region is the biggest forest region of China. Both its area of forest and timber output account for 1/3 of the total forest area and timber output of China. This region takes a pivotal position in national economy. The development of agriculture, animal husbandry, fishery, and industry cannot be separated from the development of forestry. The broadleaved/Korean pine forest and dark coniferous forest are the high-productivity forest types in this region, and the former is the famous precious timber in the world. According to the statistic data of the year 1935, the forest area of northeast China was $3.6 \times 10^7 \text{ hm}^2$, and most of the forests were broadleaved/Korean pine forest and dark coniferous forest. The Japanese plundering and the unreasonable development in recent 50 years leads to the disappearing of the original broadleaved/Korean pine forest and dark coniferous forest in most parts of the region. Now they have been generally replaced by secondary forest and artificial forest and can only be found in the natural reserve and at the steep slope of some high mountains. About two-third of 65 state forestry bureaus in northeast

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region have no timber to harvest. A series of ecological problems have been caused by forest destroy, such as shortage of resources, soil erosion, and land degradation. Consequently, the frequent inundation directly endangers the regional agriculture and economic development as well as people's life. Therefore, the renovations and restoration of forest ecosystem, scientific management and sustainable development of forestry are the primary tasks.

After 1949, the artificial pure *Larix* spp. forest was planted in a large scale in the northeast region. Larch is the famous fast-growing timber tree in the northeast regions, and makes a great effect on restoring and reconstructing forest of northeast forest region and on enhancing the economics. However, unduly emphasizing on timber production, ignoring soil acidulation, and the decrease of soil fertility caused conifer forest diseases, insect pests, and sharp decrement in production. The second-generation's production of Changbai larch forest decreases to 15% per year averagely. The decreasing of soil fertility and productivity, and low stability are the major problems affecting the sustainable development of northeast forestry. Therefore, the other chief measures on the construction and development of northeast forest are to control the decreasing of the soil fertility and productivity and to build the optimized forest ecosystems for Changbai larch forest.

Chinese fir forest region

Chinese fir is a special conifer fast-growing species in subtropics of China. Chinese fir, whose timber production accounts for 1/4 of commercial timber of China, is distributed in 16 provinces. However, research showed that continuously cropping Chinese fir would make the soil fertility decrease and the ecological condition deteriorates. In the past, it was generally considered that Chinese fir was fast growing species and its stand volume of a ten-year-old forest could reach $150 \text{ m}^3 \cdot \text{hm}^{-2}$. However, the new research showed that the productivity of Chinese fir forest in many areas was not great. The volume of the Chinese fir forest at the age of 7-8 years is less than $60 \text{ m}^3 \cdot \text{hm}^{-2}$, even less than $30 \text{ m}^3 \cdot \text{hm}^{-2}$ in some area (western Hunan province). Moreover, many plant diseases and pest insects also occur in Chinese fir forest. The decrease of soil fertility is the key problem limiting local economic development. Therefore, the primary task is to resolve soil fertility and productivity decreasing of the Chinese fir forest, and to construct an optimized model for forestry sustainable development.

Forestry in hilly region in south China

The agriculture and forest development was mainly in the south hilly region at all times. In recent 100 years, population in this region increases rapidly, and the contradiction between agriculture and forest is outstanding. Most of the peasants reclaim forestlands, and this leads to the destruction of forest vegetation, soil erosion and the decrease of soil fertility. With the economic development, improvement of people's living conditions and the increasing demand of resource by society, some short-term economic behaviors

lead to the hilly ecosystems in a deteriorating circle. Soil erosion and declining soil fertility limit local agricultural and economic development greatly. Therefore, how to renovate and utilize hills reasonably and soil resource is an important scientific question. With the development of restoration ecology, the protection and reconstruction of deteriorating ecosystems is a main topic in modern ecology. Regenerating the fundamental function of ecosystem in the degenerating hilly region and sustainable utilizing renewable biological resource are the inevitable requirement of local social and economic sustainable development.

Ecological and environmental problems related to forest destruction

Soil erosion

Soil erosion area all over China covers 38.2% of total land area now, and is $3.67 \times 10^8 \text{ hm}^2$. In recent 40 years, the decreasing cultivated land in China due to soil erosion is $2.67 \times 10^6 \text{ hm}^2$. The depth of soil erosion per year is 0.2-1.0 cm, and the total eroded soil is about 5 billions tons. Nutrient erosion equals to 0.4-billion-ton chemical fertilizer. Soil erosion leads to silting-up in river course and lake, riverbed rising, and inundation. For example, in Yichun forest region, Heilongjiang Province, soil erosion increases because of the decrease of forest area. The silt capacity increases in Tangwang River in this region; for example, the amount of silt in the 1980s was 3.8 times as much as that in the 1970s. Muling County, which is located in Sanjiang Plains (Heilongjiang River, Songhuajiang River, and Nenjiang River Plains), suffers heavy soil erosion due to destroying forest and reclaiming forestland and the depth of black soil layer has decreased from 40-50 cm to 10-20 cm in recent 30 years.

Desertification

The desertification of terrestrial ecosystem is an important global problem (Lozada 1995). The desertification area in the world is more than four billion hectares now and increases by over 6 million hectares per year. 30%-80% irrigating land is endangered by desertification, salted and alkalinified lands increase greatly. Desertification can destroy the land's recuperating ability seriously and lastingly and it also endangers plant and animal community seriously. China is one of the countries with most critical desertification in the world. The area of desertified lands in China, which covers 18.2% of total land area, is $1.747 \times 10^8 \text{ hm}^2$. Among artificial factors causing land desertification, over-grazing accounts for 34.5%, destroying forest accounts for 29.8%, unreasonable farming accounts for 28.1%, and other factors accounts for 7.9%. For instance, the land of $3.34 \times 10^8 \text{ hm}^2$ in 11 provinces and 212 counties in North China is affected by desertification, which endangers 42 millions people. Only in "Three North" areas, $1.333 \times 10^8 \text{ hm}^2$ farming land is jeopardized by wind and sand. For example, in Ke'ergin-Zuoyihouqi Area in the Inner Mongolia Autonomous Region, the area of desert land caused by

overgrazing increased from 13.7% in the 1950s to 30.8% in the 1970s. Many habitants in this area are forced to emigrate. Primeval forest in Hainan Province was $8 \times 10^5 \text{ hm}^2$ in 1956, covering 25.4% of total island area, and decreased to $3.3 \times 10^5 \text{ hm}^2$ in 1980, with a coverage of 9.8%, and even to $6.43 \times 10^4 \text{ hm}^2$ until 1994, with a coverage of 1.89%. The function of regulating and storing water of forest comes down every year. The water level of the rivers comes down and even no water in dry season. All of these inevitably result in serious desertification of land in coastal areas.

Shortage of water resource

Since the 1950s, water expenditure in the world has been increasing sharply (Pearce *et al.* 1993). The water expenditures for agriculture industry and living increased by 7, 20, and 2 times respectively from 1960 to 1975. In addition, industrial wastewater and municipal polluted water discharged is over 400 billions m^3 per year throughout the world, which pollutes 5 500 billions m^3 waters. According to the statistics of United Nations, 40% of World Rivers are polluted, and 70% of surface water in a few countries is polluted. The increase of water consumption and water pollution is the main source leading to water crisis in the world. The 60% terrestrial area in the world is short of fresh water, over 40 countries are greatly short of water resources, and 1.8 billions people drink polluted water.

The shortage of water resource in the northern China is very prominent. Many farming areas are short of water. Decrease in effective area of irrigation, over-extraction of underground water and water pollution greatly limit the development of local industry and agriculture. Even in the South China where there is plenty of rainfall, water crisis emerges. The great reduction of forest area and decrease of forest quality reduce the function of retaining water and result in soil erosion and water area silting up. Since 1949, more than 500 lakes throughout the country disappeared. The reservoir capacity decreases 40% because of silt deposition. Half of the lakes less than an area of 500 hm^2 in Yunnan Province have already disappeared. The Yellow River began to run out of water since the 1970s, and the cutout in 1996 was over 700 km and lasted 150 d. In 1995, the economic loss caused by cutout was over 6 billion yuan, and this greatly impacted on the economic development in drainage area and downstream area.

Biodiversity loss

Because of the disappearing forest, the extinct speed of biological species has an increasing trend. People are worried that many wild animals and plants will have disappeared before their utility values are found. Forest is the greatest terrene ecosystem and the most abundant biodiversity reservoir. According to the statistics and estimate of International Conservation Monitoring Center (ICMC) and International Nature Conservation Union (INCN), due to destroying primeval forest, global climate changes, desertification and environmental pollution are sharpening, and

the speed of biological extinction is 1000 times as fast as that of natural extinction. Moreover, the extinction of one species always leads to the existence crisis of 10-30 species. There are about 27 000 species of China, which accounts for 9.8% in the world. There are also 4 166 species of vertebrates in China, which accounts for 9.9% in the world. In China, about 4 000-6 000 animals and plants are endangered, and they are at the edge of extinction. Many endangered higher plants in China are unique surviving plants that have been extinct in north hemisphere. They are antique species or newborn isolated categories. Therefore, saving endangered species, protecting forest resource and improving environmental quality are the urgent tasks to be undertaken in China, even in the world.

Frequently natural disaster

The decline of forest coverage and forest function is an important factor aggravating natural disaster. Hilly land disasters such as soil erosion, mud-rock flow and mountain torrents have something to do with forest destroy directly. All kinds of natural disasters bring great loss to agricultural development and economic construction. According to statistical data, the disaster area of crops in China is 2×10^7 - $4 \times 10^7 \text{ hm}^2$ per year, reduction of crops output is $2 \times 10^8 \text{ kg}$, and the direct economic loss is 50-60 billions yuan. The disaster areas in the 1980s were 2.1 times more than that in the 1950s and 1.7 times more than that in the 1970s.

Ideas of forestry sustainable development

Forestry sustainable development demands greatly hard work of government and people as premise. First, systems containing policies and laws should be set up. Second, national policy-making department and the main scientific research department must know the importance of the relation between forestry sustainable development and basic national policy, and they also should recognize that forestry is important, indispensable. Third, under the guarantee of policies and laws, overall development strategy should be made scientifically.

Goals of forestry sustainable development

(1) With the increasing human need for forest resource, we should guarantee descendants' right of utilizing forest resource and selecting living environment as possible. (2) Through taking forest resource and forest environment as forest cost, we should entirely structure the assessment system of forest value, take forest environmental factors into account, increase forest resource reserves, harmonize local economic development and eco-environment, limit destroying forest resource and environment, and make the most of forest economic efficiency. (3) In order to achieve the goal of sustainable development, we should establish critical criterion of forest resource and forest environment, avoid all of unreasonable destroying process, maintain the health and vigor of forest, keep ecosystem in balance,

protect forest structure, function and biodiversity. (4). We should enhance the living quality of people in forestry areas and reduce the difference in life quality between forestry people and urban people. (5). We must make rational use of forest resources for enhancing sustainable development of forestry economy and realizing socially sustainable development.

Rules of forestry sustainable development

The rule of energy resources: Relying on cutting forests for fuels and timber is an unsustainable approach in developing our society, and relying on mineral fuels for economic development may lead to catastrophic changes on global climate. Therefore, a sustainable developing society will not depend on wood, coal, oil, and natural gas as energy sources for development, but on solar energy and other biotic energy as major energy sources. Especially the solar energy will be the basic energy system for a sustainable developing world.

The rule of ecological balance: A sustainable developing society has to follow the basic rules of ecological balance in land uses, i.e. rule of conserving soil nutrients, rule of keeping carbon balance, rule of conserving bio-diversity, etc, should rebuild vegetation to cover the deteriorated land and to prevent desertification, preserve old growth forests to balance the global changes and to provide natural scenery for increasing demanding on living standard, and remake the secondary forests to keep a balanced forest ecosystem and to supply resources to human society.

The rule of continuing food supply: A sustainable developing society will use various agroforestry systems as production model. An agroforestry system can not only produce food, wood, and forage, but also conserve soil nutrients and prevent erosion. A well-designed agroforestry system including forestry, agriculture, animal husbandry, fresh water fishery, sideline production, and well-scaled industry will bring the potential productivity of various lands into full play. It is a sound basis for sustainable utilizing land resources and supplying food.

Strategies of forestry sustainable development

The subject of forestry sustainable development should center on the coordinating development between human and nature. In the light of specific condition of economic development and natural resource protection, we should combine the protection, management and utility of forest with the production, consumption, recycling of forestry and intensive forest production, scientifically coordinate relationship between trades, and work out the scheme for the sustainable development.

The factors such as the quantity, quality, efficiency and environment of forest production should be comprehensively considered. On the premise of satisfying contemporary interest, the descendants' interest should be taken into full account. From the strategic view, a "limiting line" could be established for utilization of forest resources to control

the exploitation of forest resources. We also need to establish a management system of "forest sustainable development" to realize full utility of forest resource, make the most of economic efficiency of forest, and enhance social and economically sustainable development in forestry.

Through scientific protection and management we can make forest ecosystem run in self-renovation, self-maintenance and self-controlling and make the most of large ecological benefit of forest. This is the best access to ensure the coordinate development of forest and environment and to establish contemporary civilization of human and nature.

To realize the sustainable development of forestry, we should establish an efficient green assessment mechanism, perfect the tax system, induce people to make green consumption and environment protection investment, and enhance sustainable utilization of forest resource. High incomes must submit high taxes and provide high environmental compensation.

We must emphasize education and scientific research. Environmental consciousness and green education must be taught from kindergarten. Special courses about sustainable development may be offered in every period of education. Special-used funds from 'forest sustain' or environmental taxes are set up to sustain related education and scientific research.

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